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## CLAIMS

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[Claim(s)]

[Claim 1]An antenna system which receives an electric wave from a satellite and outputs latitude of a receiving place, longitude, and advanced position data.

A portable remote terminal which edits a character, a number, and a figure which were displayed on a display with a light pen and in which a document and program creation are possible.

Magnetic media with which this portable remote terminal was equipped and which memorized an investigation item beforehand.

A timer which clocks time and outputs temporal data.

A video camera which carries out video photographing of the subject of search, and outputs a video signal, and a portable telephone transmitted and received to a radio dial-up line.

An analog-to-digital conversion circuit which is the field research data acquisition system provided with the above, and generates still picture information from said video signal, A synthetic circuit which combines this still picture information, said position data, and temporal data, and outputs a composite signal is provided, Said position data is become final and conclusive with said antenna system in a position which observes a subject of search, Carry out video photographing of the subject of search with said video camera, reach a video signal, and said analog-to-digital conversion circuit generates said still picture information, Become final and conclusive temporal data at the time of investigation with said timer, and said composite signal is become final and conclusive from settled temporal data, position data, and generated still picture information, Observational data which creates a comment about a subject of search with said portable remote terminal and a light pen, and consists of said composite signal these-become final and conclusive and a comment is memorized to said magnetic media, and said observational data was transmitted to a radio dial-up line by said portable telephone if needed.

[Claim 2]An antenna system which receives an electric wave from a satellite and outputs latitude of a receiving place, longitude, and advanced position data.

A portable remote terminal which edits a character, a number, and a figure which were displayed on a display with a light pen and in which a document and program creation are possible.

Magnetic media with which this portable remote terminal was equipped and which memorized an investigation item beforehand.

A timer which clocks time and outputs temporal data.

A video camera which carries out video photographing of the subject of search, and outputs a video signal, and a portable telephone transmitted and received to a radio dial-up line. An analog-to-digital conversion circuit which is the field research data acquisition system provided with the above, and generates still picture information from said video signal, A synthetic circuit which combines this still picture information, said position data, and temporal data, and outputs a composite signal, Establish a magnetic needle meter which measures magnetic bearing on geography, and said position data is become final and conclusive with said antenna system in a position which observes a subject of search, Carry out video photographing of the subject of search with said video camera, reach a video signal, and said analog-to-digital conversion circuit generates said still picture information, Become final and conclusive temporal data at the time of investigation with said timer, and said composite signal is become final and conclusive from settled temporal data, position data, and generated still picture information, Magnetic-bearing data of bearing of the exposure axis of said video camera is become final and conclusive with said magnetic needle meter, A comment about a subject of search is created with said portable remote terminal and a light pen, Observational data which consists of said composite signal and magnetic-bearing data which were these-become final and conclusive, and a comment is memorized to said magnetic media, Said observational data is transmitted to a radio dial-up line by said portable telephone if needed, and a computer formed in a remote place received said observational data via a radio dial-up line.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to a field research data acquisition system, especially the investigation data collecting apparatus in the outdoors which combined the landscape image with digital data.

[0002]

[Description of the Prior Art]In the sampling extraction by field research, an investigator brings the map and memo pad of 1/25,000, it checks that a direct going and subject-of-search thing is in a certain portion in the map, and the subject-of-search place of the area A, and the seal of a point or a round head is written in the corresponding section on a map. The number was given to the corresponding section into which the seal of a point or a round head was put, the number was copied on the memo pad, and the comment about a corresponding section is filled in. They are another areas B and C about the same investigation... It carries out at each

place, and enters collectively on one map of 1/25,000 later, and a distribution map which distribution of the wide range understands at a glance is created. Every place region A, B, and C ... The memo pad containing a number is arranged in order of the consecutive numbers of continuation, taking care that the comment about each survey point does not become a number difference, and is packed into the comment book of one sheet or one volume.

[0003]

[Problem(s) to be Solved by the Invention]In the sampling extraction by the conventional field research, since it investigates by bringing a map and a memo pad, according to the environmental circumstances, a map and a memo pad may be damp, or it may become dirty, and an entry position may become unknown on a rainy day. The reference number was \*\*\*\*\*\*(ed) and there was fear of the destination of a comment getting confused on a comment book. When collecting into synthetic broader-based data from the individual data of an every place region, many time and labors are spent on collation with each partial map, and arrangement of data after the data sampling with the still greater labor therefore. The data which gathered was enough, and since reliance was also only digital data, it was scientifically weak as material evidence when clarifying legal responsibility. The field research data acquisition system by this invention increases the efficiency of data collection work [ in the outdoors ] by leaps and bounds by using a video camera and personal computer peripheral equipment as a terminal, combines image data with numerical data, and realizes the system which has depth in the amount of information.

[0004]

[Means for Solving the Problem]In this invention, with a GPS device and a light pen, a document and a portable remote terminal in which program creation is possible, Magnetic media with which this portable remote terminal was equipped and which memorized an investigation item beforehand, and a timer, A device which consists of a video camera and a radio portable telephone is used, and an analog-to-digital conversion circuit which generates still picture information from a video signal, a synthetic circuit which combines this still picture information, position data, and temporal data, and outputs a composite signal, and a magnetic needle meter which measures magnetic bearing on geography are established.

[0005]

[Function]Become final and conclusive position data with a GPS device in the position which observes a subject of search, carry out video photographing of the subject of search with a video camera, and a video signal and an analog-to-digital conversion circuit generate still picture information, Become final and conclusive the temporal data at the time of investigation with a timer, and a composite signal is become final and conclusive from settled temporal data, position data, and the generated still picture information, Become final and conclusive the magnetic-bearing data of the bearing of the exposure axis of a video camera with a magnetic needle meter, and the comment about a subject of search is created with a portable remote terminal and a light pen, The observational data which consists of the composite signal and magnetic-bearing data which were these-become final and conclusive, and a comment is memorized to magnetic media, observational data is transmitted to a radio dial-up line by portable telephone if needed, and the computer formed in the remote place receives observational data via a radio dial-up line. Even if it does not go to the spot, a specialist can analyze the present condition by computer formed in the remote place. Since the specialist does not need to go to the dangerous spot, a lot of investigation can perform him easily. Since position data, image data, and digital data are combined and it is obtained simultaneously, it can use also as legal data of evidence.

[0006]

[Example]Next, the example of this invention is described with reference to drawings. Drawing 2 is an outline view of the device which performs the field survey in the outdoors

concerning this invention. The antenna system 1 of the GPS receiver with which the device which performs the field survey in the outdoors receives the electric wave from a satellite, It comprises the main part 10 of the notebook type computer (personal computer) which equipped the side front with the display 2, the digital camera 30, the magnetic needle 11 [ a total of ] that measures the direction from magnetic north, and the cellular phone 35 in which radio use is possible.

[0007]the notebook type computer 10 is small at a thin shape -- carrying -- it is easy, and this main part 10 and antenna system 1 are a RS232C cable, and the digital camera 30 and the cellular-phone cellular phone 35 connect them by a predetermined cable. The main part 10 builds in a small disk drive and an IC card reading-and-writing device, and can equip with a disk or an IC card. Hereafter, an IC card is explained to an example as a storage which memorizes the digital map and program of basic data. The field research data collection station 19 with GPS consists of these antenna systems 1, the main part 10, the digital camera 30, the magnetic needle 11 [ a total of ], and the cellular-phone cellular phone 35.

[0008]Now, GLOBAL POSITIONING SYSTEM (GPS: all the earth position grasping systems), Wherever it may catch the electric wave of three or more satellites and may be in [ of the global ground, marine, and the air ] out of 24 satellites launched by the universe, it is a system which can know its exact position in real time. The position (latitude, longitude, altitude) and information on time are transmitted from each satellite. The antenna system 1 receives the signal about a position with a time signal, two or more balls which made distance from each satellite the radius are created, and the intersection of these balls serves as its position. If four sets of satellites are receivable, the latitude on the earth, longitude, and an altitude can be measured. This latitude, longitude, and an altitude are the positions of the antenna system 1 (themselves).

[0009]Drawing 1 is a detailed block diagram of a device and the field research data collection station 19 with GPS which realizes the field research data acquisition system concerning this invention. The electric wave from a satellite is received by the antenna system 1, and a position signal is sent to the central arithmetic unit (CPU) 4 from the antenna system 1. The antenna system 1 is provided with a calculation function, creates the ball which made the radius distance from four sets of satellites, and computes one intersection of these balls. The antenna system 1 outputs this intersection as the latitude on the earth, longitude, and altitude data ( $X_i, Y_i, E_i$ ), i.e., a position signal. The antenna system 1 and CPU4 are connected by the RS232C cable 17.

[0010]It is IC card 6 (the case where it is an IC card reader is explained) which set information, including latitude, longitude, an altitude (Elevation), etc., as each position (coordinates) on a map beforehand. That is, it is the digital map data which had determined latitude and longitude on the map internationally and was electronized. These days, the optical disc and floppy disk (FD) of the digital map which covered the whole world from the special company of each country are marketed globally. Although the additional remark landmark etc. are recorded on IC card 6 besides GPS data, time, a comment, and a memo can be added. A position signal is processed by CPU4 using the program in read-only memory ROM5. Together with a map, CPU1 is plotted, overlaps on a digital map and displays the computed position point on the coordinates which consist of latitude on the display 2, and longitude (it is the same as the usual car navigator).

[0011]It shall be provided although the antenna system 1, the main part 10, the digital camera 30 for videos, the cellular phone 35, and the cell that supplies electric power to the display 2 are not illustrated, either. Were controlled by CPU4, and select the menu on the display 2, it was made to have performed various programs, or to start and end, and the light pen 3 equips the tip part with the click button which directs decision of each instruction step. CPU4 uses RAM7 at the time of the operation and various kinds of operations which combine a position

signal with map data. An output is possible for the data in RAM7 and IC card 6 to the various external computers 21 via input/output device I/O9 if needed. The timer 23 is carrying out firm output of the highly precise time signal to CPU4.

[0012]In addition to the above-mentioned map data, IC card 6 is provided with the data table showing what is investigated how in the next tables 1 and 2 beforehand programmed by computer 13. The data table of Tables 1 and 2 can be created in the computer 21 grade of an information center using an IC card reading-and-writing device. The digital camera 30 is the usual television camera, and can carry out video photographing of the scene of a survey point. The tape recorder 32 requires the video image of a scene on recording via the interface 34. As for a video image, a still picture is generated by the analog digital converter (A/D conversion circuit) 31. It is combined by the position signal ( $X_i$ ,  $Y_i$ ,  $E_i$ ) and the synthetic circuit 33 from the antenna system 1, and the still picture information of this DEJITA is stored in IC card 6. It is combined by the position signal ( $X_i$ ,  $Y_i$ ,  $E_i$ ) and the interface 34 from the antenna system 1, and the video image of a scene is stored in the voice recording field of the tape recorder 32.

[0013]The cellular phone 35 consists of the ten key part 38, the modem section 37, and the dispatch part 36, has a function as a usual mobile phone simple substance, and can transmit IC card 6 and the data in RAM7 to a radio dial-up line by the instructions from CPU4. The main part 10 uses the cellular phone 35, and data receiving is also more possible for it than the exterior of a radio dial-up line by operation of CPU4. Apple Computer "NEWTON" is used for the display 2 which constitutes the main part main part 10, the light pen 3, CPU4, ROM5, IC card 6, RAM7, I/O9, and the timer 23, for example. The GPS receiver, the magnetic compass, video camera, and cellular phone which are marketed are used for the antenna system 1, magnetic needle a total of 11 digital cameras 30, and the cellular phone 35, respectively.

[0014]Since it measures of which direction magnetic needle 11 [ a total of ] photoed the scene, display magnetic north (0 times) is aligned with the optical axis direction of the lens of the digital camera 30 and a magnetic needle always turns to the north of geomagnetism, The direction of a field of view of the digital camera 30 (magnetic bearing, MH) can read in the difference of a magnetic needle and display magnetic north by viewing. Next, the contents set as IC card 6 about each investigation when it was the landslide investigation in the outdoors are explained.

[0015]

[0016]

[0017]The case where safe investigation of a bank or a bank is conducted at the time of rise of water of summer is actually explained. An investigator brings and assigns the field research data collection device equipped with this IC card 6, and goes to the bank of Tonegawa of the area A (Ryugasaki near [ for example, ]). 1/25,000 of the maps of Kanto which each investigation item (the numbers 1, 2, and 3 and ... the data of correspondence is unentered) of the data table of Tables 1 and 2 is memorized by IC card 6, and includes Toride may be memorized. After arriving at Tonegawa's bank, the main part 10, the antenna system 1, the digital camera 30, and the electric power switch of the cellular phone 35 are turned on, and GPS (all the earth position grasping systems) is operated. On the display 2 of the main part main part 10, the position which actually stands for the investigator is always expressed as a round dot seal etc. like the usual car navigator.

[0018]an investigator -- point attainment of a river -- if it carries out, click operation of the aggressiveness button key of the light pen 3 is carried out, and an incorporation input is directed. CPU4 incorporates the time which includes the present position (always expressed as a round dot seal etc.) for a date the what times east longitude and what [ north latitude ] times from the antenna system 1, respectively, and it records it in the above-mentioned table in IC card 6. an investigator -- the situation of the water-contacting area of a bank -- water nature, the existence of collapse, etc. -- a comment -- it enters by carrying out and the scene considered to be important with the digital camera 30 is photoed in video. Although this video image is automatically recorded on the tape recorder 32, the days-and-months time from the timer 23, the what times east longitude from the antenna system 1, and what [ north latitude ] times, altitude data is added to this video image by I/F34, and is simultaneously recorded on it by the voice recording field of a tape.

[0019]Click operation of the button key which incorporates a still picture is carried out, the important portion of the video images is digitized in the A/D conversion circuit 31, a still picture image is generated, and it records in the above-mentioned table in IC card 6. And an investigator reads 270 magnetic bearing (MAGNETICHEADING) in the direction which the digital camera 30 had turned to, enters with the light pen 3 like a comment, and records in the above-mentioned table in IC card 6. If there is an investigator with necessity, as shown in Tables 1 and 2 in addition to photography of the scene of a western direction, he does video

photographing also of for [ of the direction of plurality ] north directions, the east direction, and the situation of a Namikata-oriented bank in identical time at the same point mostly, and can record on the form of image data in a similar manner.

[0020]CPU4 regards it as under measurement of the time, and if there are return directions, it will be made into the measuring finish of the time, until it incorporates, it judges the number-of-times pause eye of an input and there are return directions (established input). If the data stored into IC card 6 becomes and a symbol display is carried out about each measuring spot from the longitude latitude and the altitude which are the contents of Table 1 and Table 2, the observation scene in the position, its direction of a field of view, and time, it will turn into the observational data Gi (Xi, Yi, Ei, Si, MHi, Ti). The flow of a river and the video image of scenery which moves are recorded in parallel with the tape recorder 32 separately [ a still picture ].

[0021]Now, on the map of the Geographical Survey Institute of 1/25,000, when 1 mm is increased 25,000 times, it is  $25000 \times 10(4\text{th} [-]\text{ power})\text{m}=25\text{m}$ . On a actual map, since it becomes the same width as what did write-in work with the pen whose thickness is about 1 mm as a matter of fact even if the thickness of a pen or a pencil is 1 mm or less, it is thought that a landslide investigation position can distinguish and enter in a 25-m error span.

[0022]Now, the antenna system 1 outputs the data of a second bit for 41 minutes, 05 etc. seconds, etc. 35 minutes and 40 seconds, and north latitude 35 degrees east longitude 135 degrees as a position signal, for example. 1 time is 60 minutes, and since 1 minute is 60 seconds, it has been 3600 seconds once. Since 1 nautical mile is 1852 m in 60 nautical miles, 1 time on the earth is set to  $60 \times 1852 \text{ m}$ . The distance for 1 second is  $(60 \times 1852) / (3600) = 1852 / 60 = 30.86 \text{ m}$ . the output data of the antenna system 1 of the display accuracy of the display 2 is one second bit in a geographic coordinate here -- it is set to 30.86 m from things, and is mostly in agreement with 25 m of the entry accuracy in the map of the Geographical Survey Institute of 1/25,000.

[0023]now, the case where the engineering-works specialist who does not require it with the map of the Geographical Survey Institute of 1/25,000 there even if a landslide birthplace point is recorded in about 30-m accuracy, and an administration person in charge see -- Kawamuki -- like this -- or -- a border between prefectures, Chiba Prefecture, and Ibaragi Prefecture -- the important judgment which it is is difficult in many cases. However, if there is image data of the scene of Table 2 in addition to position data, it glances, and \*\*\*\*\* is attached [ in which prefecture side it is, and ], and the specialist of the way can determine measures. Since it understands in which direction there is any direction of a field of view of the image data of a scene by magnetic bearing, he can understand well also for the specialist who analyzes at other places so that the status information of a spot may be in a actual site survey.

[0024]When required for the time of observation of the landslide situation of the bank by rise of water gathering, or an emergency notice, the investigation data of recorded IC card 6 and the contents of Tables 1 and 2 can be transmitted to the computer 21 of an information gathering center via the cellular phone 35. The measures adapted to a local situation can be prepared or implemented in the center. In another investigation, when investigating abandonment of the unjust industrial waste to a dry riverbed, for example, When not only the abandonment distribution but the abandonment spot is discovered, the observational data Gi (Xi, Yi, Ei, Si, MHi, Ti) of longitude latitude, an altitude, the observation scene in the position, its direction of a field of view, and time can collect correctly. The collected observational data Gi deserves being legally adopted as material evidence at the time of the measure. The field research data acquisition system of this application is applicable to distribution investigation of animal vegetation, housing distribution investigation, an employee's habitation distribution, a student's habitation distribution, road repair investigation, geology, geographical feature cloth investigation, etc.

[0025]

[Effect of the Invention]As explained above, with a GPS device and a light pen A document and the portable remote terminal in which program creation is possible, The magnetic media with which this portable remote terminal was equipped and which memorized the investigation item beforehand, and a timer, A video camera and the analog-to-digital conversion circuit which uses a radio portable telephone and generates still picture information from a video signal, The synthetic circuit which combines this still picture information, position data, and temporal data, and outputs a composite signal, Establish the magnetic needle meter which measures magnetic bearing, and position data is become final and conclusive with a GPS device in the position which observes a subject of search, Carry out video photographing of the subject of search with a video camera, reach a video signal, and an analog-to-digital conversion circuit generates still picture information, Become final and conclusive the temporal data at the time of investigation with a timer, and a composite signal is become final and conclusive from settled temporal data, position data, and the generated still picture information, Become final and conclusive the magnetic-bearing data which observed bearing of the exposure axis with the magnetic needle meter, and the comment about a subject of search is created with a portable remote terminal and a light pen, Memorize the observational data which consists of the composite signal and magnetic-bearing data which were these-become final and conclusive, and a comment to said magnetic media, transmit observational data to a radio dial-up line by portable telephone if needed, and account observational data recovers to the computer formed in the remote place, It analyzes. Since exact investigation data and the images of local information are collected in this way, information content of collection data improves by leaps and bounds. Field research in real time can be carried out because the authorized personnel who have physical strength in the field spot attend and the analysis investigator skilled in the remote place attends. The measures in an emergency can real-perform promptly by instant acquisition of data. The investigated observational data becomes what is enough borne as material evidence, and can be utilized for assignment of subsequent burden sharing.

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## **TECHNICAL FIELD**

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[Industrial Application]This invention relates to a field research data acquisition system, especially the investigation data collecting apparatus in the outdoors which combined the landscape image with digital data.

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## **PRIOR ART**

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[Description of the Prior Art]In the sampling extraction by field research, an investigator brings the map and memo pad of 1/25,000, it checks that a direct going and subject-of-search thing is in a certain portion in the map, and the subject-of-search place of the area A, and the seal of a point or a round head is written in the corresponding section on a map. The number was given to the corresponding section into which the seal of a point or a round head was put, the number was copied on the memo pad, and the comment about a corresponding section is filled in. They are another areas B and C about the same investigation... It carries out at each place, and enters collectively on one map of 1/25,000 later, and a distribution map which distribution of the wide range understands at a glance is created. Every place region A, B, and C ... The memo pad containing a number is arranged in order of the consecutive numbers of continuation, taking care that the comment about each survey point does not become a number difference, and is packed into the comment book of one sheet or one volume.

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## **EFFECT OF THE INVENTION**

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[Effect of the Invention]As explained above, with a GPS device and a light pen A document and the portable remote terminal in which program creation is possible, The magnetic media with which this portable remote terminal was equipped and which memorized the investigation item beforehand, and a timer, A video camera and the analog-to-digital

conversion circuit which uses a radio portable telephone and generates still picture information from a video signal, The synthetic circuit which combines this still picture information, position data, and temporal data, and outputs a composite signal, Establish the magnetic needle meter which measures magnetic bearing, and position data is become final and conclusive with a GPS device in the position which observes a subject of search, Carry out video photographing of the subject of search with a video camera, reach a video signal, and an analog-to-digital conversion circuit generates still picture information, Become final and conclusive the temporal data at the time of investigation with a timer, and a composite signal is become final and conclusive from settled temporal data, position data, and the generated still picture information, Become final and conclusive the magnetic-bearing data which observed bearing of the exposure axis with the magnetic needle meter, and the comment about a subject of search is created with a portable remote terminal and a light pen, Memorize the observational data which consists of the composite signal and magnetic-bearing data which were these-become final and conclusive, and a comment to said magnetic media, transmit observational data to a radio dial-up line by portable telephone if needed, and account observational data recovers to the computer formed in the remote place, It analyzes. Since exact investigation data and the images of local information are collected in this way, information content of collection data improves by leaps and bounds. Field research in real time can be carried out because the authorized personnel who have physical strength in the field spot attend and the analysis investigator skilled in the remote place attends. The measures in an emergency can real-perform promptly by instant acquisition of data. The investigated observational data becomes what is enough borne as material evidence, and can be utilized for assignment of subsequent burden sharing.

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## **TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention]In the sampling extraction by the conventional field research, since it investigates by bringing a map and a memo pad, according to the environmental circumstances, a map and a memo pad may be damp, or it may become dirty, and an entry position may become unknown on a rainy day. The reference number was \*\*\*\*\*\*(ed) and there was fear of the destination of a comment getting confused on a comment book. When collecting into synthetic broader-based data from the individual data of an every place region, many time and labors are spent on collation with each partial map, and arrangement of data after the data sampling with the still greater labor therefore. The data which gathered was enough, and since reliance was also only digital data, it was scientifically

weak as material evidence when clarifying legal responsibility. The field research data acquisition system by this invention increases the efficiency of data collection work [ in the outdoors ] by leaps and bounds by using a video camera and personal computer peripheral equipment as a terminal, combines image data with numerical data, and realizes the system which has depth in the amount of information.

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## MEANS

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[Means for Solving the Problem]In this invention, with a GPS device and a light pen, a document and a portable remote terminal in which program creation is possible, Magnetic media with which this portable remote terminal was equipped and which memorized an investigation item beforehand, and a timer, A device which consists of a video camera and a radio portable telephone is used, and an analog-to-digital conversion circuit which generates still picture information from a video signal, a synthetic circuit which combines this still picture information, position data, and temporal data, and outputs a composite signal, and a magnetic needle meter which measures magnetic bearing on geography are established.

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## OPERATION

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[Function]Become final and conclusive position data with a GPS device in the position which observes a subject of search, carry out video photographing of the subject of search with a

video camera, and a video signal and an analog-to-digital conversion circuit generate still picture information, Become final and conclusive the temporal data at the time of investigation with a timer, and a composite signal is become final and conclusive from settled temporal data, position data, and the generated still picture information, Become final and conclusive the magnetic-bearing data of the bearing of the exposure axis of a video camera with a magnetic needle meter, and the comment about a subject of search is created with a portable remote terminal and a light pen, The observational data which consists of the composite signal and magnetic-bearing data which were these-become final and conclusive, and a comment is memorized to magnetic media, observational data is transmitted to a radio dial-up line by portable telephone if needed, and the computer formed in the remote place receives observational data via a radio dial-up line. Even if it does not go to the spot, a specialist can analyze the present condition by computer formed in the remote place. Since the specialist does not need to go to the dangerous spot, a lot of investigation can perform him easily. Since position data, image data, and digital data are combined and it is obtained simultaneously, it can use also as legal data of evidence.

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## EXAMPLE

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[Example]Next, the example of this invention is described with reference to drawings. Drawing 2 is an outline view of the device which performs the field survey in the outdoors concerning this invention. The antenna system 1 of the GPS receiver with which the device which performs the field survey in the outdoors receives the electric wave from a satellite, It comprises the main part 10 of the notebook type computer (personal computer) which equipped the side front with the display 2, the digital camera 30, the magnetic needle 11 [ a total of ] that measures the direction from magnetic north, and the cellular phone 35 in which radio use is possible.

[0007]the notebook type computer 10 is small at a thin shape -- carrying -- it is easy, and this main part 10 and antenna system 1 are a RS232C cable, and the digital camera 30 and the cellular-phone cellular phone 35 connect them by a predetermined cable. The main part 10 builds in a small disk drive and an IC card reading-and-writing device, and can equip with a disk or an IC card. Hereafter, an IC card is explained to an example as a storage which memorizes the digital map and program of basic data. The field research data collection station 19 with GPS consists of these antenna systems 1, the main part 10, the digital camera 30, the magnetic needle 11 [ a total of ], and the cellular-phone cellular phone 35.

[0008]Now, GLOBAL POSITIONING SYSTEM (GPS: all the earth position grasping systems), Wherever it may catch the electric wave of three or more satellites and may be in [

of the global ground, marine, and the air ] out of 24 satellites launched by the universe, it is a system which can know its exact position in real time. The position (latitude, longitude, altitude) and information on time are transmitted from each satellite. The antenna system 1 receives the signal about a position with a time signal, two or more balls which made distance from each satellite the radius are created, and the intersection of these balls serves as its position. If four sets of satellites are receivable, the latitude on the earth, longitude, and an altitude can be measured. This latitude, longitude, and an altitude are the positions of the antenna system 1 (themselves).

[0009] Drawing 1 is a detailed block diagram of a device and the field research data collection station 19 with GPS which realizes the field research data acquisition system concerning this invention. The electric wave from a satellite is received by the antenna system 1, and a position signal is sent to the central arithmetic unit (CPU) 4 from the antenna system 1. The antenna system 1 is provided with a calculation function, creates the ball which made the radius distance from four sets of satellites, and computes one intersection of these balls. The antenna system 1 outputs this intersection as the latitude on the earth, longitude, and altitude data ( $X_i$ ,  $Y_i$ ,  $E_i$ ), i.e., a position signal. The antenna system 1 and CPU4 are connected by the RS232C cable 17.

[0010] It is IC card 6 (the case where it is an IC card reader is explained) which set information, including latitude, longitude, an altitude (Elevation), etc., as each position (coordinates) on a map beforehand. That is, it is the digital map data which had determined latitude and longitude on the map internationally and was electronized. These days, the optical disc and floppy disk (FD) of the digital map which covered the whole world from the special company of each country are marketed globally. Although the additional remark landmark etc. are recorded on IC card 6 besides GPS data, time, a comment, and a memo can be added. A position signal is processed by CPU4 using the program in read-only memory ROM5. Together with a map, CPU1 is plotted, overlaps on a digital map and displays the computed position point on the coordinates which consist of latitude on the display 2, and longitude (it is the same as the usual car navigator).

[0011] It shall be provided although the antenna system 1, the main part 10, the digital camera 30 for videos, the cellular phone 35, and the cell that supplies electric power to the display 2 are not illustrated, either. Were controlled by CPU4, and select the menu on the display 2, it was made to have performed various programs, or to start and end, and the light pen 3 equips the tip part with the click button which directs decision of each instruction step. CPU4 uses RAM7 at the time of the operation and various kinds of operations which combine a position signal with map data. An output is possible for the data in RAM7 and IC card 6 to the various external computers 21 via input/output device I/O9 if needed. The timer 23 is carrying out firm output of the highly precise time signal to CPU4.

[0012] In addition to the above-mentioned map data, IC card 6 is provided with the data table showing what is investigated how in the next tables 1 and 2 beforehand programmed by computer 13. The data table of Tables 1 and 2 can be created in the computer 21 grade of an information center using an IC card reading-and-writing device. The digital camera 30 is the usual television camera, and can carry out video photographing of the scene of a survey point. The tape recorder 32 requires the video image of a scene on recording via the interface 34. As for a video image, a still picture is generated by the analog digital converter (A/D conversion circuit) 31. It is combined by the position signal ( $X_i$ ,  $Y_i$ ,  $E_i$ ) and the synthetic circuit 33 from the antenna system 1, and the still picture information of this DEJITA is stored in IC card 6. It is combined by the position signal ( $X_i$ ,  $Y_i$ ,  $E_i$ ) and the interface 34 from the antenna system 1, and the video image of a scene is stored in the voice recording field of the tape recorder 32.

[0013] The cellular phone 35 consists of the ten key part 38, the modem section 37, and the dispatch part 36, has a function as a usual mobile phone simple substance, and can transmit IC

card 6 and the data in RAM7 to a radio dial-up line by the instructions from CPU4. The main part 10 uses the cellular phone 35, and data receiving is also more possible for it than the exterior of a radio dial-up line by operation of CPU4. Apple Computer "NEWTON" is used for the display 2 which constitutes the main part main part 10, the light pen 3, CPU4, ROM5, IC card 6, RAM7, I/O9, and the timer 23, for example. The GPS receiver, the magnetic compass, video camera, and cellular phone which are marketed are used for the antenna system 1, magnetic needle a total of 11 digital cameras 30, and the cellular phone 35, respectively.

[0014] Since it measures of which direction magnetic needle 11 [ a total of ] photoed the scene, display magnetic north (0 times) is aligned with the optical axis direction of the lens of the digital camera 30 and a magnetic needle always turns to the north of geomagnetism, The direction of a field of view of the digital camera 30 (magnetic bearing, MH) can read in the difference of a magnetic needle and display magnetic north by viewing. Next, the contents set as IC card 6 about each investigation when it was the landslide investigation in the outdoors are explained.

[0015]  
表1 : データテーブル

| コード番号：本体100111 場所： 調査名：地滑り 担当者： |       |          |                    |     |    |     |
|---------------------------------|-------|----------|--------------------|-----|----|-----|
| 番号                              | 前兆、現況 | 時間       | GPS場所：E N          | 月日  | 景観 | MH  |
| 1                               | 含水性大  | 12 30 11 | 38 45 26 130 10 33 | 7 2 | S1 | 360 |
| 2                               | 崩壊開始  | 17 11 22 | 38 45 28 130 10 31 | 7 2 | S2 | 045 |
| 3                               | 異常無し  | 22 12 05 | 38 45 30 130 10 32 | 7 2 | S3 | 270 |
| 4                               | 異常無し  | 22 12 10 | 38 45 30 130 10 32 | 7 2 | S4 | 360 |
| 5                               | 異常無し  | 0 12 15  | 38 45 30 130 10 32 | 7 2 | S5 | 090 |
| 6                               | 異常無し  | 22 12 20 | 38 45 30 130 10 32 | 7 2 | S6 | 180 |
| .                               |       |          |                    |     |    |     |

[0016]

表2：データテーブル

| 番号 | 景観 状況       | MH磁方位 |
|----|-------------|-------|
| S1 | イメージ1 今にも崩壊 | 真北    |
| S2 | イメージ2 少し崩壊  | 北東    |
| S3 | イメージ3 雨の川岸  | 真西    |
| S4 | イメージ3 雨の川   | 真北    |
| S5 | イメージ3 雨の堤防  | 真東    |
| S6 | イメージ3 雨の川原  | 真西    |
| ・  | ・           | ・     |

[0017]The case where safe investigation of a bank or a bank is conducted at the time of rise of water of summer is actually explained. An investigator brings and assigns the field research data collection device equipped with this IC card 6, and goes to the bank of Tonegawa of the area A (Ryugasaki near [ for example, ]). 1/25,000 of the maps of Kanto which each investigation item (the numbers 1, 2, and 3 and ... the data of correspondence is unentered) of the data table of Tables 1 and 2 is memorized by IC card 6, and includes Toride may be memorized. After arriving at Tonegawa's bank, the main part 10, the antenna system 1, the digital camera 30, and the electric power switch of the cellular phone 35 are turned on, and GPS (all the earth position grasping systems) is operated. On the display 2 of the main part main part 10, the position which actually stands for the investigator is always expressed as a round dot seal etc. like the usual car navigator.

[0018]an investigator -- point attainment of a river -- if it carries out, click operation of the aggressiveness button key of the light pen 3 is carried out, and an incorporation input is directed. CPU4 incorporates the time which includes the present position (always expressed as a round dot seal etc.) for a date the what times east longitude and what [ north latitude ] times from the antenna system 1, respectively, and it records it in the above-mentioned table in IC card 6. an investigator -- the situation of the water-contacting area of a bank -- water nature, the existence of collapse, etc. -- a comment -- it enters by carrying out and the scene considered to be important with the digital camera 30 is photoed in video. Although this video image is automatically recorded on the tape recorder 32, the days-and-months time from the timer 23, the what times east longitude from the antenna system 1, and what [ north latitude ] times, altitude data is added to this video image by I/F34, and is simultaneously recorded on it by the voice recording field of a tape.

[0019]Click operation of the button key which incorporates a still picture is carried out, the important portion of the video images is digitized in the A/D conversion circuit 31, a still picture image is generated, and it records in the above-mentioned table in IC card 6. And an investigator reads 270 magnetic bearing (MAGNETICHEADING) in the direction which the digital camera 30 had turned to, enters with the light pen 3 like a comment, and records in the above-mentioned table in IC card 6. If there is an investigator with necessity, as shown in Tables 1 and 2 in addition to photography of the scene of a western direction, he does video

photographing also of for [ of the direction of plurality ] north directions, the east direction, and the situation of a Namikata-oriented bank in identical time at the same point mostly, and can record on the form of image data in a similar manner.

[0020]CPU4 regards it as under measurement of the time, and if there are return directions, it will be made into the measuring finish of the time, until it incorporates, it judges the number-of-times pause eye of an input and there are return directions (established input). If the data stored into IC card 6 becomes and a symbol display is carried out about each measuring spot from the longitude latitude and the altitude which are the contents of Table 1 and Table 2, the observation scene in the position, its direction of a field of view, and time, it will turn into the observational data Gi (Xi, Yi, Ei, Si, MHi, Ti). The flow of a river and the video image of scenery which moves are recorded in parallel with the tape recorder 32 separately [ a still picture ].

[0021]Now, on the map of the Geographical Survey Institute of 1/25,000, when 1 mm is increased 25,000 times, it is  $25000 \times 10(4\text{th} [-]\text{ power})m = 25m$ . On a actual map, since it becomes the same width as what did write-in work with the pen whose thickness is about 1 mm as a matter of fact even if the thickness of a pen or a pencil is 1 mm or less, it is thought that a landslide investigation position can distinguish and enter in a 25-m error span.

[0022]Now, the antenna system 1 outputs the data of a second bit for 41 minutes, 05 etc. seconds, etc. 35 minutes and 40 seconds, and north latitude 35 degrees east longitude 135 degrees as a position signal, for example. 1 time is 60 minutes, and since 1 minute is 60 seconds, it has been 3600 seconds once. Since 1 nautical mile is 1852 m in 60 nautical miles, 1 time on the earth is set to  $60 \times 1852$  m. The distance for 1 second is  $(60 \times 1852) / (3600) = 1852 / 60 = 30.86$  m. the output data of the antenna system 1 of the display accuracy of the display 2 is one second bit in a geographic coordinate here -- it is set to 30.86 m from things, and is mostly in agreement with 25 m of the entry accuracy in the map of the Geographical Survey Institute of 1/25,000.

[0023]now, the case where the engineering-works specialist who does not require it with the map of the Geographical Survey Institute of 1/25,000 there even if a landslide birthplace point is recorded in about 30-m accuracy, and an administration person in charge see -- Kawamuki -- like this -- or -- a border between prefectures, Chiba Prefecture, and Ibaragi Prefecture -- the important judgment which it is is difficult in many cases. However, if there is image data of the scene of Table 2 in addition to position data, it glances, and \*\*\*\*\* is attached [ in which prefecture side it is, and ], and the specialist of the way can determine measures. Since it understands in which direction there is any direction of a field of view of the image data of a scene by magnetic bearing, he can understand well also for the specialist who analyzes at other places so that the status information of a spot may be in a actual site survey.

[0024]When required for the time of observation of the landslide situation of the bank by rise of water gathering, or an emergency notice, the investigation data of recorded IC card 6 and the contents of Tables 1 and 2 can be transmitted to the computer 21 of an information gathering center via the cellular phone 35. The measures adapted to a local situation can be prepared or implemented in the center. In another investigation, when investigating abandonment of the unjust industrial waste to a dry riverbed, for example, When not only the abandonment distribution but the abandonment spot is discovered, the observational data Gi (Xi, Yi, Ei, Si, MHi, Ti) of longitude latitude, an altitude, the observation scene in the position, its direction of a field of view, and time can collect correctly. The collected observational data Gi deserves being legally adopted as material evidence at the time of the measure. The field research data acquisition system of this application is applicable to distribution investigation of animal vegetation, housing distribution investigation, an employee's habitation distribution, a student's habitation distribution, road repair investigation, geology, geographical feature cloth investigation, etc.

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[Translation done.]

\* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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## **DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] It is a block circuit diagram of the field research data collection device of this invention.

[Drawing 2] It is an entire configuration figure of the field research data acquisition system of this invention.

[Description of Notations]

- 1 Antenna system
- 2 Display
- 3 Light pen
- 4 CPU
- 5 ROM
- 6 IC card
- 7 RAM
- 9 I/O
- 10 Main part
- 11 Magnetic needle meter
- 17 Connecting cable
- 13 Computer
- 19 Field research data collection device
- 23 Timer
- 30 Video camera
- 31 A/D conversion circuit
- 32 Tape recorder
- 33 Synthetic circuit
- 34 Interface
- 35 Cellular phone

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[Translation done.]

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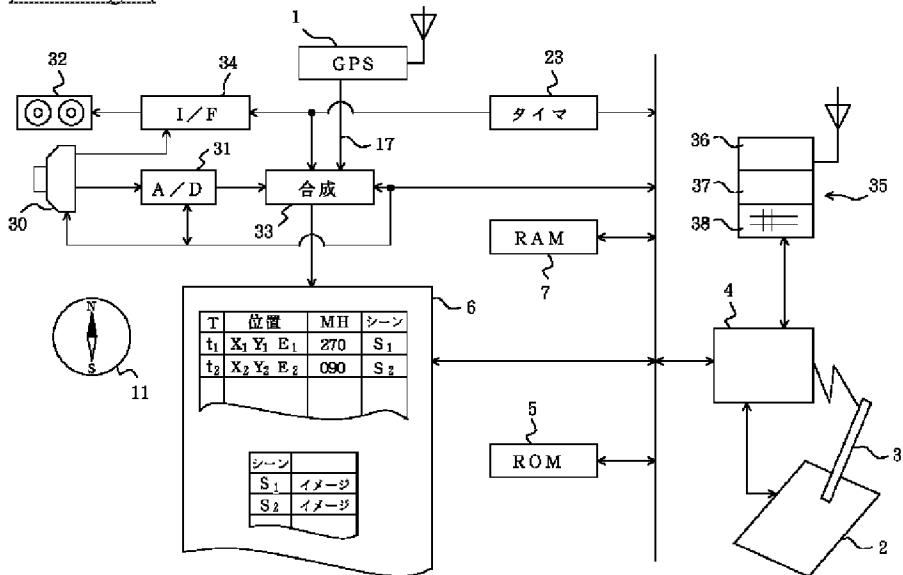
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## DRAWINGS

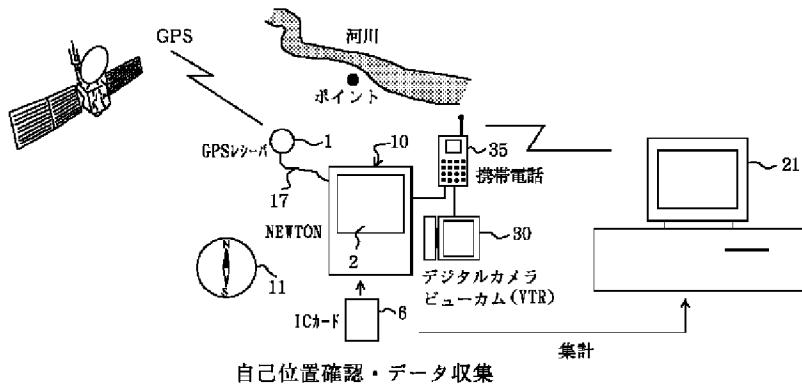
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[Drawing 1]



[Drawing 2]

緊急連絡・映像保存



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[Translation done.]

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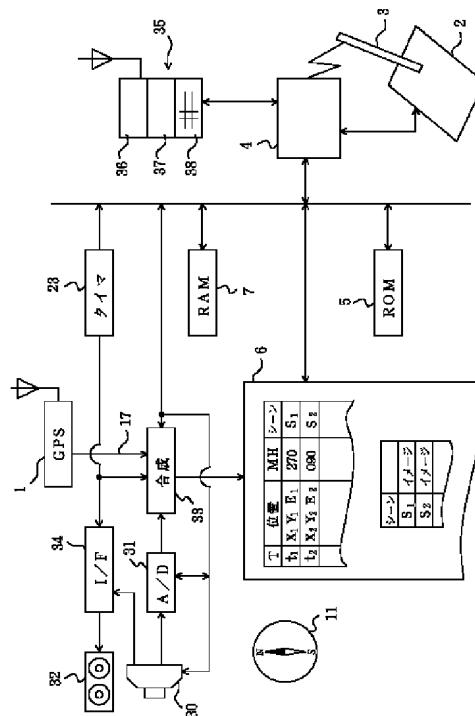
(74)代理人 弁理士 八嶋 敬市

(54)【発明の名称】 野外調査データ収集システム

(57)【要約】 (修正有)

【目的】リアルタイムで野外調査の分析が実施でき、証拠物件として十分耐える調査データを得る。

【構成】調査対象を観測する位置でGPS装置により位置データを確定し、ビデオカメラ30により調査対象をビデオ撮影して、アナログ・デジタル変換回路31により静止画像データを生成し、調査した時間データ、位置データ及び静止画像データから合成信号を確定し、磁針計11により撮影方向の磁方位データを確定する。あと、ライトペン3により調査対象に関するコメントを作成し、確定した合成信号、磁方位データ及びコメントよりなる観測データを磁気媒体に記憶32し、携帯用電話35により観測データを無線公衆電話回線に送信し、遠隔地に設けたコンピュータで観測データを回収して解析する。



## 【特許請求の範囲】

【請求項1】 衛星からの電波を受信して受信地の緯度、経度、高度の位置データを出力するアンテナ装置と、表示装置に表示された文字や数字や図形をライトペンにより編集して、文書やプログラム作成が可能な携帯用端末と、この携帯用端末に装着され調査項目を予め記憶した磁気媒体と、時間を計時し時間データを出力するタイマと、調査対象をビデオ撮影しビデオ信号を出力するビデオカメラと、無線公衆電話回線に送受信する携帯用電話とからなる装置であって、

前記ビデオ信号から静止画像データを生成するアナログ・デジタル変換回路と、この静止画像データと前記位置データと時間データを結合して合成信号を出力する合成回路とを設け、

調査対象を観測する位置で前記アンテナ装置により前記位置データを確定し、前記ビデオカメラにより調査対象をビデオ撮影してビデオ信号をおよび前記アナログ・デジタル変換回路により前記静止画像データを生成し、前記タイマにより調査時の時間データを確定し、確定した時間データと位置データと生成した静止画像データとから前記合成信号を確定し、前記携帯用端末とライトペンにより調査対象に関するコメントを作成し、これら確定した前記合成信号とコメントよりなる観測データを前記磁気媒体に記憶し、

必要に応じて前記携帯用電話により前記観測データを無線公衆電話回線に送信するようにしたことを特徴とする野外調査データ収集システム。

【請求項2】 衛星からの電波を受信して受信地の緯度、経度、高度の位置データを出力するアンテナ装置と、表示装置に表示された文字や数字や図形をライトペンにより編集して、文書やプログラム作成が可能な携帯用端末と、この携帯用端末に装着され調査項目を予め記憶した磁気媒体と、時間を計時し時間データを出力するタイマと、調査対象をビデオ撮影しビデオ信号を出力するビデオカメラと、無線公衆電話回線に送受信する携帯用電話とからなる装置であって、

前記ビデオ信号から静止画像データを生成するアナログ・デジタル変換回路と、この静止画像データと前記位置データと時間データを結合して合成信号を出力する合成回路と、地理上の磁方位を計測する磁針計とを設け、

調査対象を観測する位置で前記アンテナ装置により前記位置データを確定し、前記ビデオカメラにより調査対象をビデオ撮影してビデオ信号をおよび前記アナログ・デジタル変換回路により前記静止画像データを生成し、前記タイマにより調査時の時間データを確定し、確定した時間データと位置データと生成した静止画像データとから前記合成信号を確定し、前記磁針計により前記ビデオカメラの撮影方向の磁方位データを確定し、前記携帯用端末とライトペンにより調査対象に関するコメントを作成し、これら確定した前記合成信号と磁方位データとコ

メントよりなる観測データを前記磁気媒体に記憶し、必要に応じて前記携帯用電話により前記観測データを無線公衆電話回線に送信し、遠隔地に設けたコンピュータで前記前記観測データを無線公衆電話回線を介して受信するようにしたことを特徴とする野外調査データ収集システム。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 本発明は、野外調査データ収集システム、特に景観画像を数値データに組み合わせた野外での調査データ収集装置に関する。

## 【0002】

【従来の技術】 野外調査によるサンプリング採取では、調査員が例えば2万5千分の1の地図とメモ帳を持参して、その地図内のある部分、地域Aの調査対象場所に直接行き、調査対象物があることを確認して、地図上の該当箇所に点や丸の印を書き入れている。点や丸の印を入れた該当箇所には番号を付し、その番号をメモ帳に写して該当箇所についてのコメントを記入している。同様な調査を別の地域B、C・・・の各場所で行い、後で1枚の2万5千分の1の地図上にまとめて記入し、広い範囲の分布が一見して分かるような分布地図を作成している。各地域A、B、C・・・の番号入りメモ帳は、各調査地点に関するコメントが番号違いにならないように注意しながら連続の通し番号順に整理して、1枚または1冊のコメント帳にまとめている。

## 【0003】

【発明が解決しようとする課題】 従来の野外調査によるサンプリング採取では、地図とメモ帳を持参して調査を行うので、環境の状況次第では、雨の日には、地図とメモ帳が濡れたり汚れたりして、記入位置が不明になったりすることがある。またコメント帳上で、整理番号を過ったりして、コメントの行く先が混乱してしまう等のおそれがあった。各地域の個別データから総合的な広域データにまとめる時、各部分地図との照合、データの整理になお、多大な労力を伴い、そのためにデータサンプリング後に多くの時間と労力を費やしている。また、集合したデータは科学的には十分であっても、数値データだけなので、法律上の責任を明確にする上での証拠物件としては弱いものであった。この発明による野外調査データ収集システムはビデオカメラとパソコン周辺機器を端末として野外でのデータ収集作業を飛躍的に効率化し、画像データを数値のデータと結合して、情報量に深みのあるシステムを実現する。

## 【0004】

【課題を解決するための手段】 本願の発明では、G P S装置と、ライトペンにより文書やプログラム作成が可能な携帯用端末と、この携帯用端末に装着され調査項目を予め記憶した磁気媒体と、タイマと、ビデオカメラと、無線携帯用電話とからなる装置を使用し、ビデオ信号か

ら静止画像データを生成するアナログ・デジタル変換回路と、この静止画像データと位置データと時間データを結合して合成信号を出力する合成回路と、地理上の磁方位を計測する磁針計とを設ける。

#### 【0005】

【作用】調査対象を観測する位置でGPS装置により位置データを確定し、ビデオカメラにより調査対象をビデオ撮影してビデオ信号およびアナログ・デジタル変換回路により静止画像データを生成し、タイマにより調査時の時間データを確定し、確定した時間データと位置データと生成した静止画像データとから合成信号を確定し、磁針計によりビデオカメラの撮影方向の磁方位データを確定し、携帯用端末とライトペンにより調査対象に関するコメントを作成し、これら確定した合成信号と磁方位データとコメントよりなる観測データを磁気媒体に記憶し、必要に応じて携帯用電話により観測データを無線公衆電話回線に送信し、遠隔地に設けたコンピュータで観測データを無線公衆電話回線を介して受信する。現場に行かなくとも、遠隔地に設けたコンピュータで専門家が現況を解析できる。専門家は危険な現場に出かける必要がないので、大量の調査が容易に実行できる。位置データと画像データと数値データとが結合されて同時に得られるので、法的な証拠データとしても利用できる。

#### 【0006】

【実施例】次に、本発明の実施例について図面を参照して説明する。図2は本発明に係る、野外での現地調査を行う装置の外観図である。野外での現地調査を行う装置は、衛星からの電波を受信するGPSレシーバーのアンテナ装置1と、表側に表示装置2を備えた手帳型コンピュータ（パソコン）の本体10と、デジタルカメラ30と、磁北からの向きを計る磁針計11と、無線使用が可能な携帯電話35とから構成されている。

【0007】手帳型コンピュータ10は薄型で小型で携帯容易であり、この本体10とアンテナ装置1とはRS232Cケーブルで、またデジタルカメラ30および携帯電話携帯電話35とは所定のケーブルで接続する。本体10は小型ディスクドライブやICカード読み書き装置を内蔵し、ディスクやICカードが装着できる。以下、基本データのデジタル地図やプログラムを記憶する記憶媒体として、ICカードを例に説明する。これらアンテナ装置1と本体10とデジタルカメラ30と磁針計11と携帯電話携帯電話35とでGPS付き野外調査データ収集端末19を構成する。

【0008】さて、GLOBAL POSITIONING SYSTEM (GPS:全地球位置把握システム)は、宇宙に打ち上げられた24個の衛星の中から、3個以上の衛星の電波をキャッチして全世界の地上、海上、空中のどこにいても、自分の正確な位置をリアルタイムで知ることができるシステムである。各衛星からその位置（緯度、経度、高度）と時刻の情報が送信されて

くる。時間信号とともに位置に関する信号をアンテナ装置1で受信し、各衛星からの距離を半径とした球を複数作成し、これらの球の交点が自分の位置となる。4基の衛星が受信できれば地球上の緯度、経度、高度が測定できる。この緯度、経度、高度がアンテナ装置1（自分）の位置である。

【0009】図1は本発明に係る野外調査データ収集システムを実現する装置、GPS付き野外調査データ収集端末19の詳細なブロック図である。衛星からの電波はアンテナ装置1で受信され、アンテナ装置1から位置信号が中央演算装置(CPU)4に送られる。アンテナ装置1は演算機能を備え、4基の衛星からの距離を半径とした球を作成し、これら球の交点を1つ算出する。この交点を地球上の緯度、経度、高度データとして、即ち位置信号(Xi, Yi, Ei)としてアンテナ装置1が出力する。アンテナ装置1とCPU4とはRS232Cケーブル17で接続する。

【0010】予め地図上の各位置（座標）に緯度、経度、高度(Elevation)などの情報を設定したものがICカード6（ICカード読み取り装置の場合を説明する）である。即ち、緯度、経度は国際的に地図上で決定しており、電子化したものがデジタル地図データである。最近では各国の専門会社から全世界をカバーしたデジタル地図の光ディスクやフロッピーディスク(FD)が世界的に市販されている。ICカード6にはGPSデータの他に付記的なランドマーク等が記録されているが、更に時間やコメントやメモが追記できる。位置信号は、読み出し専用メモリROM5にあるプログラムを使用してCPU4により処理される。CPU1は算出した位置点を、表示装置2上の緯度、経度からなる座標に、地図と合せて、プロットし、デジタル地図上にオーバーラップして表示する（通常のカーナビゲーターと同じ）。

【0011】アンテナ装置1、本体10、ビデオ用のデジタルカメラ30、携帯電話35、表示装置2に電力を供給する電池も図示しないが設けられているものとする。ライトペン3はCPU4により制御され、表示装置2上のメニューを選択して、各種プログラムを実行させたり、始動、終了させたりし、各命令ステップの確定を指示するクリックボタンをその先端部には備えている。CPU4は位置信号を地図データと結合する演算や各種の演算時にRAM7を使用する。RAM7、ICカード6内のデータは入出力装置I/O9を介して、必要に応じて外部の各種コンピュータ21に出力可能である。タイマー23は高精度の時刻信号をCPU4に常時出力している。

【0012】ICカード6は、前述の地図データに加えて、何をどのように調査するかを予めコンピュータ13によりプログラムされた次の表1、2に示すデータテーブルを備えている。表1、2のデータテーブルは、情報

センターのコンピュータ21等でICカード読み書き装置を使用して作成できる。デジタルカメラ30は通常のテレビカメラであり、調査地点の景観をビデオ撮影できる。景観のビデオイメージはインターフェース34を介してテープレコーダ32に録画している。またビデオイメージはアナログ・ディジタルコンバータ(A/D変換回路)31で静止画像が生成される。このデジタルの静止画像データは、アンテナ装置1からの位置信号(Xi, Yi, Ei)と合成回路33により結合されて、ICカード6に格納される。また景観のビデオイメージは、アンテナ装置1からの位置信号(Xi, Yi, Ei)とインターフェース34により結合されて、テープレコーダ32の音声記録領域に格納される。

【0013】携帯電話35はテンキ一部38とモデム部37と発信部36からなり、通常の移動電話単体としての機能を有し、CPU4からの指令によりICカード6やRAM7内のデータを無線公衆電話回線に送信できる。本体10は携帯電話35を利用し、CPU4の動作

表1：データテーブル

| コード番号：本体100111場所： |       |          |           | 調査名：地滑り 担当者： |     |    |     |
|-------------------|-------|----------|-----------|--------------|-----|----|-----|
| 番号                | 前兆、現況 | 時間       | GPS場所：E N |              | 月日  | 景観 | MH  |
| 1                 | 含水性大  | 12 30 11 | 38 45 26  | 130 10 33    | 7 2 | S1 | 360 |
| 2                 | 崩壊開始  | 17 11 22 | 38 45 28  | 130 10 31    | 7 2 | S2 | 045 |
| 3                 | 異常無し  | 22 12 05 | 38 45 30  | 130 10 32    | 7 2 | S3 | 270 |
| 4                 | 異常無し  | 22 12 10 | 38 45 30  | 130 10 32    | 7 2 | S4 | 360 |
| 5                 | 異常無し  | 0 12 15  | 38 45 30  | 130 10 32    | 7 2 | S5 | 090 |
| 6                 | 異常無し  | 22 12 20 | 38 45 30  | 130 10 32    | 7 2 | S6 | 180 |
| •                 |       |          |           |              |     |    |     |

【0016】

により、無線公衆電話回線の外部よりデータ受信も可能である。本体本体10を構成する表示装置2、ライトペン3、CPU4、ROM5、ICカード6、RAM7、I/O9、タイマー23には、例えばアップルコンピュータ「NEWTON」を使用する。また、アンテナ装置1、磁針計11、デジタルカメラ30、携帯電話35には市販されているGPSレシーバ、磁気コンパス、ビデオカメラ、携帯電話をそれぞれ使用する。

【0014】磁針計11はどの方向の景観を撮影したかを測定するもので、表示磁北(0度)はデジタルカメラ30のレンズの光軸方向に合わせてあり、磁針が當時地磁気の北を向くので、磁針と表示磁北との差から、デジタルカメラ30の視界方向(磁方位、MH)が、目視により読み取れる。次に、個々の調査について例えば、野外での地滑り調査である場合に、ICカード6に設定した内容について説明する。

【0015】

表2：データテーブル

| 番号 | 景観 状況      | MH磁方位 |
|----|------------|-------|
| S1 | イメージ1今にも崩壊 | 真北    |
| S2 | イメージ2少し崩壊  | 北東    |
| S3 | イメージ3雨の川岸  | 真西    |
| S4 | イメージ3雨の川   | 真北    |
| S5 | イメージ3雨の堤防  | 真東    |
| S6 | イメージ3雨の川原  | 真西    |
| ・  | ・          | ・     |

【0017】実際に、夏の増水時に堤防や土手の安全調査を実施する場合を説明する。調査員はこのICカード6を装着した野外調査データ収集装置を持参して割り当て地域A、例えば竜ヶ崎市近くの利根川の土手に出向く。ICカード6には表1、2のデータテーブルの各調査項目（番号1、2、3、・・・対応のデータは未記入）が記憶されており、また取手市を含む関東の2万5千分の1の地図が記憶されていてもいい。利根川の土手に着いた後、本体10とアンテナ装置1とデジタルカメラ30と携帯電話35の電源スイッチをいれて、GPS（全地球位置把握システム）を動作させる。本体本体10の表示装置2上には通常のカーナビゲーターのように、調査員の実際に立っている位置が丸点印等で常時表示される。

【0018】調査員は川のポイント到達するとライトペン3の押しボタンキーをクリック操作して、取り込み入力を指示する。CPU4は、アンテナ装置1から現在の位置（丸点印等で常時表示される）を東経何度、北緯何度、年月日を含む時刻、を夫々取り込み、ICカード6内の上記テーブル内に記録する。調査員が土手の接水地域の状況について、含水性や崩壊の有無等をコメントとして記入し、デジタルカメラ30で重要と思われる景観をビデオに撮影する。このビデオイメージは自動的にテープレコーダ32に録画されるが、このビデオイメージには、タイマ23からの月日時間と、アンテナ装置1からの東経何度、北緯何度、高度データがI/F34により加算されて、テープの音声記録領域に同時に記録される。

【0019】静止画像を取り込むボタンキーをクリック操作し、ビデオ像内の重要な部分をA/D変換回路31でデジタル化して、静止画像イメージを生成し、ICカード6内の上記テーブル内に記録する。そして、調査

員はデジタルカメラ30が向いていた方向での磁方位（MAGNETICHEADING）270度を読み取り、コメントと同様にライトペン3で記入し、ICカード6内の上記テーブル内に記録する。調査員は、必要とあらば、西方向の景観の撮影に加えて表1、2に示すように、同一地点でほぼ同一時刻において、複数方向の北方向、東方向、南方向の土手の状況も、ビデオ撮影し、同様に画像データの形に記録できる。

【0020】CPU4は取り込み入力の回数区切り目を判断し、リターン指示（確定入力）があるまで、その回の測定中とみなし、リターン指示があればその回の測定終了にする。ICカード6内に蓄積されるデータは、各測定地点について、表1、表2の内容である経度緯度、高度、その位置での観測景観、その視界方向、時刻からなり、記号表示すると、観測データGi(Xi, Yi, Ei, Si, MHi, Ti)となる。また、川の流れや動く風景のビデオ画像は、静止画像とは別途に、テープレコーダ32に平行して記録されている。

【0021】さて、2万5千分の1の国土地理院の地図上では1mmは、2万5千倍すると、 $25000 \times 10^{-4}$ 乗m=25mである。実際の地図上では、ペンや鉛筆の太さが1mm以下であっても、事実上は太さが1mm程度のペンで書き込み作業をしたものと同様な幅となるので、25mの誤差範囲内で地滑り調査位置が区別して記入できると考えられる。

【0022】さてアンテナ装置1は位置信号として、例えば、東経135度35分40秒、北緯35度41分05秒等、秒単位のデータを出力する。1度は60分で、1分は60秒なので、1度は3600秒となる。地球上の1度は、60海里で1海里は1852mなので、すなわち $60 \times 1852$ mとなる。1秒の距離は $(60 \times 1852) / (3600) = 1852 / 60 = 30.86$ mである。ここで表示装置2の表示精度は、アンテナ装置1の出力データが経緯度で1秒単位であることから30.86mとなり、2万5千分の1の国土地理院の地図での記入精度の25mとほぼ一致する。

【0023】さて、地滑り発生地点が、2万5千分の1の国土地理院の地図で、約30m精度で記録されたとしても、現地にいない土木専門家や行政担当者が見た場合は、川向こうか、県境か、千葉県、茨城県どちらかという重要な判定が困難な場合が多い。しかし、位置データに加えて表2の景観のイメージデータがあれば、一瞥して、その道の専門家はどの県側にあるのか即判断が付き、対応策が決定できる。更に、景観のイメージデータの視界方向が磁方位でどの方向にあるかわかるので、現地の状況情報が、実際の調査現場にいるように、他の場所で解析する専門家にとってもよく理解できる。

【0024】増水による土手の地滑り状況の観測が揃った時点、または、緊急通知に必要な場合には、携帯電話35を介して、記録済のICカード6の調査データ、表

1、2の内容を情報収集センターのコンピュータ21に転送できる。センターでは現地状況に即した、対応策を準備したり、実施したりできる。また、別の調査では、例えば河川敷への不当な産業廃棄物の投棄を調査する際には、その投棄分布のみならず、投棄現場を発見した場合には、経度緯度、高度、その位置での観測景観、その視界方向、時刻の観測データ $G_i(X_i, Y_i, E_i, S_i, M_i, T_i)$ が正確に収集できる。収集した観測データ $G_i$ は、その対策時には、法的に証拠物件として、採用されるに値するものとなる。更に本願の野外調査データ収集システムは、動物植物の分布調査、住宅分布調査、社員の居住分布、学生の居住分布、道路補修調査、地質、地形布調査等に応用できる。

[0 0 2 5]

【発明の効果】以上説明してきたように、G P S装置と、ライトペンにより文書やプログラム作成が可能な携帯用端末と、この携帯用端末に装着され調査項目を予め記憶した磁気媒体と、タイマと、ビデオカメラと、無線携帯用電話を使用し、ビデオ信号から静止画像データを生成するアナログ・デジタル変換回路と、この静止画像データと位置データと時間データを結合して合成信号を出力する合成回路と、磁方位を計測する磁針計とを設け、調査対象を観測する位置でG P S装置により位置データを確定し、ビデオカメラにより調査対象をビデオ撮影してビデオ信号をおよびアナログ・デジタル変換回路により静止画像データを生成し、タイマにより調査時の時間データを確定し、確定した時間データと位置データと生成した静止画像データとから合成信号を確定し、磁針計により撮影方向を観測した磁方位データを確定し、携帯用端末とライトペンにより調査対象に関するコメントを作成し、これら確定した合成信号と磁方位データとコメントよりなる観測データを前記磁気媒体に記憶し、必要に応じて携帯用電話により観測データを無線公衆電話回線に送信し、遠隔地に設けたコンピュータに記観測データで回収し、解析する。かくして、正確な調査データ

タと、現地情報の映像とを収集するので、回収データの情報内容が飛躍的に向上する。フィールド現場には体力のある作業員が立ち会い、遠隔地では熟練した分析調査員が立ち会うことで、リアルタイムでの野外調査が実施できる。データの即時入手により緊急時での対応策が実即行できる。調査した観測データは、証拠物件として十分耐えるものとなり、事後の責任分担の割り振りに活用できる。

### 【図面の簡単な説明】

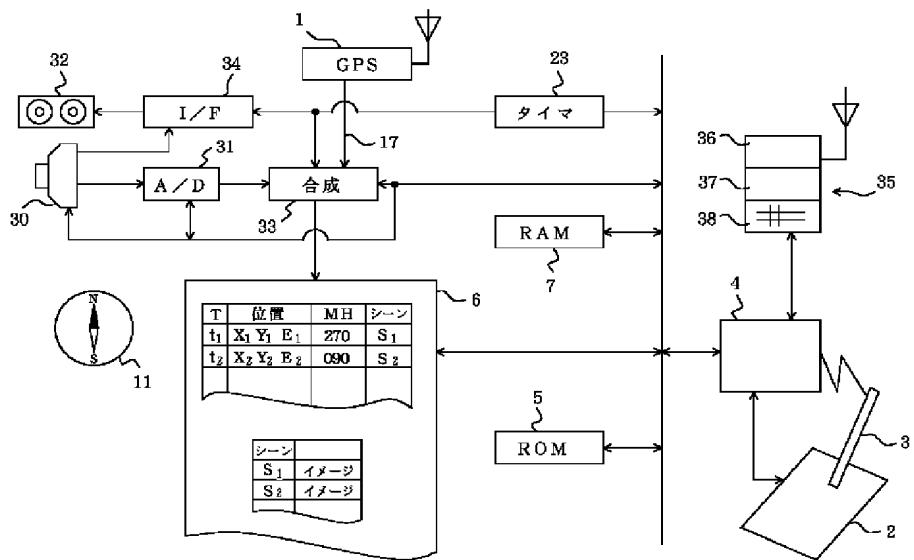
- 10 【図1】本発明の野外調査データ収集装置のブロック回路図である。

【図2】本発明の野外調査データ収集システムの全体構成図である。

【符号の説明】

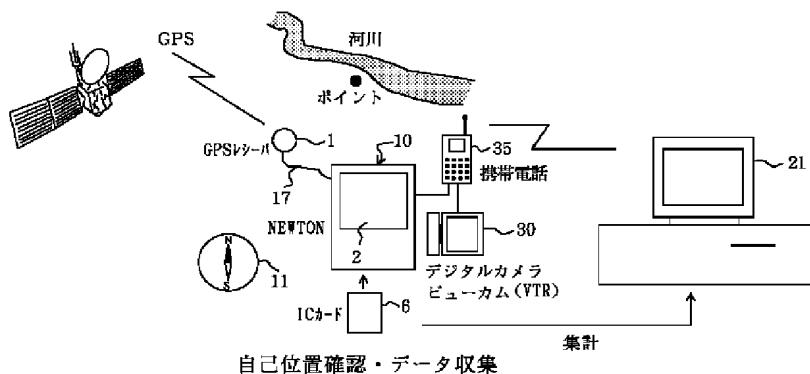
  - 1 アンテナ装置
  - 2 表示装置
  - 3 ライトペン
  - 4 C P U
  - 5 R O M
  - 20 6 I Cカード
  - 7 R A M
  - 9 I / O
  - 10 本体
  - 11 磁針計
  - 17 接続ケーブル
  - 13 コンピュータ
  - 19 野外調査データ収集装置
  - 23 タイマー
  - 30 ビデオカメラ
  - 30 31 A / D変換回路
  - 32 テープレコーダ
  - 33 合成回路
  - 34 インターフェース
  - 35 携帯電話

【図1】



【図2】

緊急連絡・映像保存



自己位置確認・データ収集